

# Afterschool Astronomy:

## Bringing the Universe Down to Earth

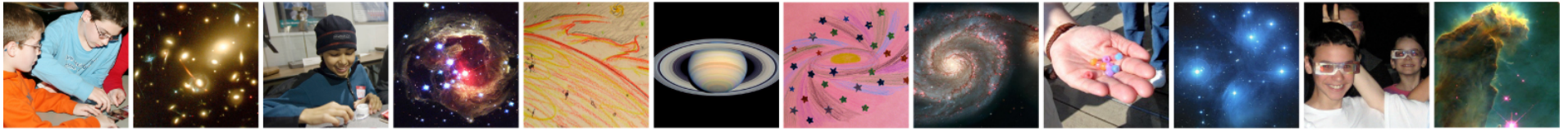
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*NASA Goddard Space Flight Center, Greenbelt, MD*

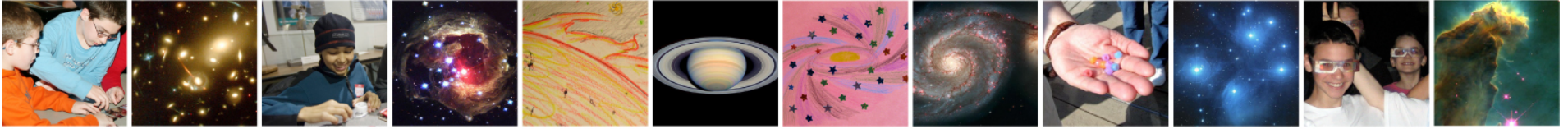


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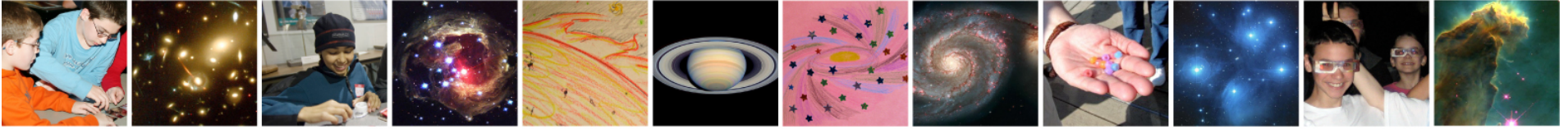




# Goals for Today

- ★ To walk you through hands-on astronomy activities you can immediately use in your programming
- ★ To share freely-available astronomy-themed curriculum support materials from NASA, including full session write-ups for today's activities
- ★ To share research and best practices on STEM programming in out-of-school time environments

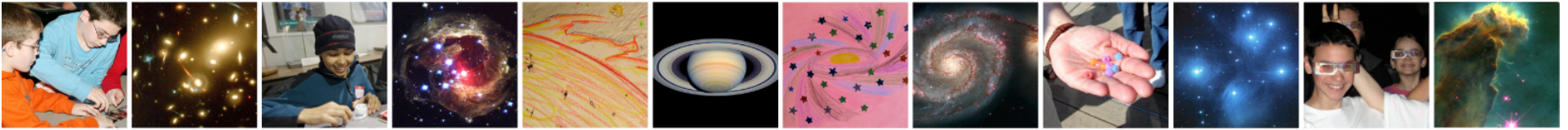




# What is STEM?

- ★ Science, Technology, Engineering, & Mathematics
- ★ Necessary skills for competitiveness in today's global marketplace
- ★ Job market for STEM careers keeps growing
- ★ US students lag behind many other nations in pursuit of STEM degrees and success in STEM fields
- ★ Nationwide push to increase STEM learning and competitiveness in all levels of education



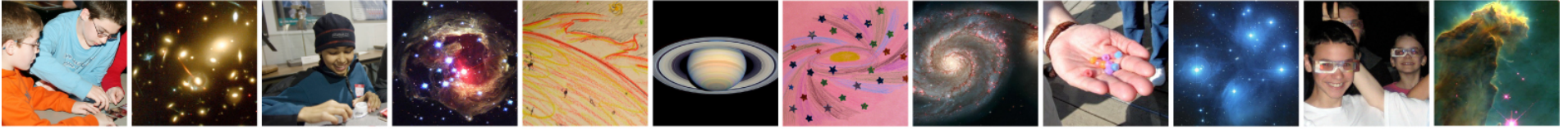


# Why Out-of-School-Time?

- ★ Best practices in science education include lots of hands-on and inquiry – need time and flexibility
- ★ Formal education has limited time for and focus on STEM, OST offers increased opportunities
- ★ STEM content in school is often “scary,” OST offers a more relaxed setting to enjoy STEM
- ★ Research shows that STEM learning thrives in OST settings



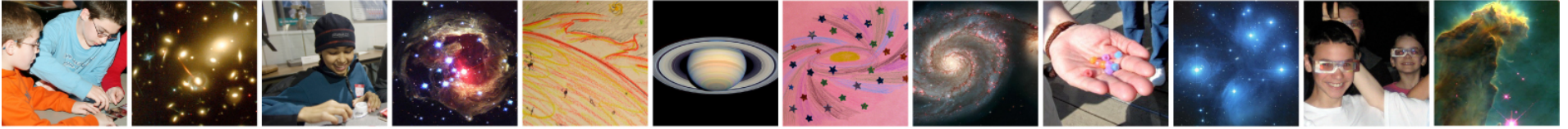




# STEM/OST Research

- ★ As youth get older they report significantly less interest and self-confidence in their science ability. Children ages 6–12 report a high level of interest and belief in their science abilities; by age 14, interest and self-confidence related to science drops off. (U.S. Department of Education, 2000)

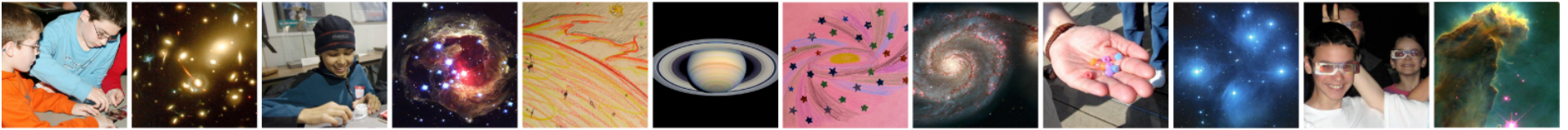




# STEM/OST Research

- ★ Both learners and teachers need more time — not to do more of the same, but to use all time in new, different, and better ways. The key to liberating learning lies in unlocking time. (National Education Commission on Time and Learning, 1994)



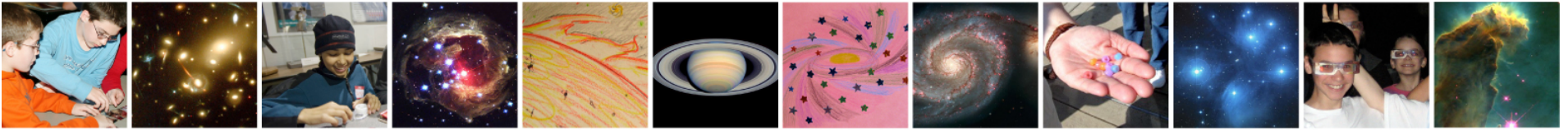


# STEM/OST Research

- ★ After-school settings are optimal for providing engaging, hands-on STEM experiences, enabling students to apply, reinforce, and extend skills and concepts taught in school. And they are particularly conducive to project-based activities where a wide variety of children can participate in the design, construction, investigation, sense-making, and communication of science projects. (Coalition for Science After School, 2004)



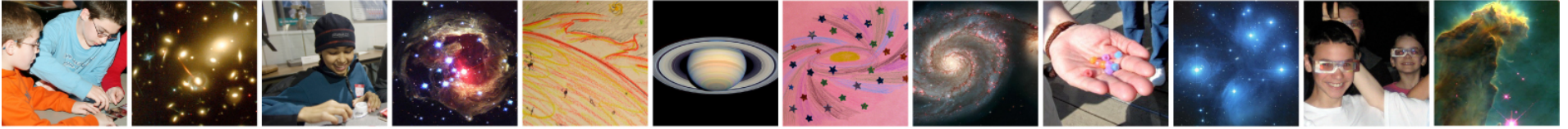




# STEM/OST Best Practices

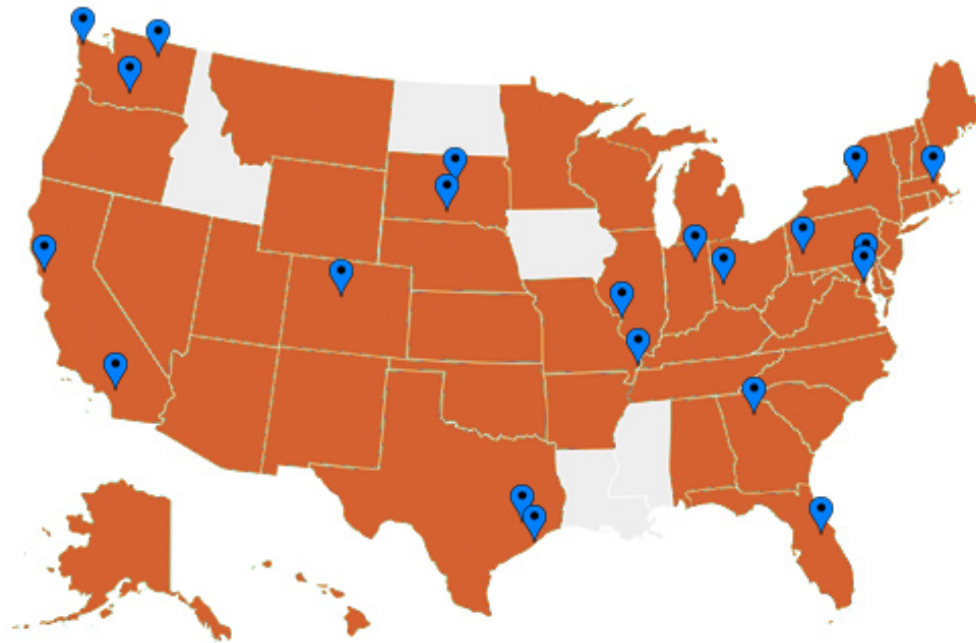
- ★ STEM education can take many forms – hands-on, demonstrations, experiments, kinesthetic activities, art, writing, and more
- ★ STEM is often competitive, about “right answers”
- ★ In OST, increased focus on experience, process, attitudes over content knowledge
- ★ OST programs provide opportunities for role modeling, self-paced exploration, and ongoing learning



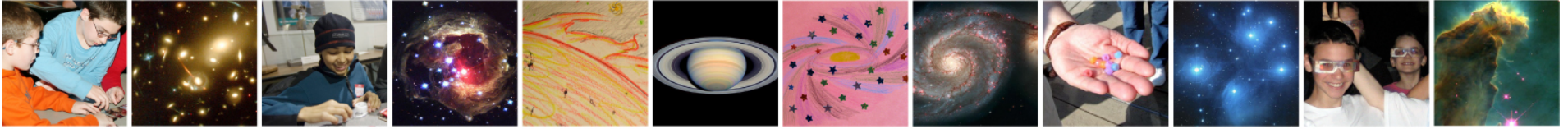


# Informal Education Curricula from Goddard's Astrophysics Science Division

- ★ Formally evaluated by external evaluation consultants
- ★ Approved by the NASA Science Education Product Review
- ★ Programs with national reach and recognition



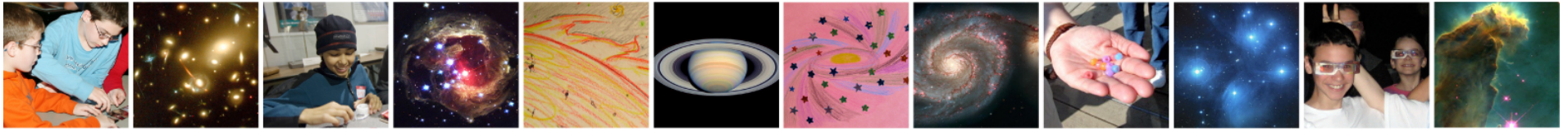
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# What is Afterschool Universe?

- ★ 12-session curriculum (45–60 minutes each)
- ★ Explores the Universe beyond our solar system and how we study it
- ★ Designed for middle-schoolers in out-of-school-time
- ★ No preliminary science knowledge required for program leader – we give all necessary background
- ★ Very hands-on with interdisciplinary learning techniques
- ★ Flexible implementation to suit different schedules





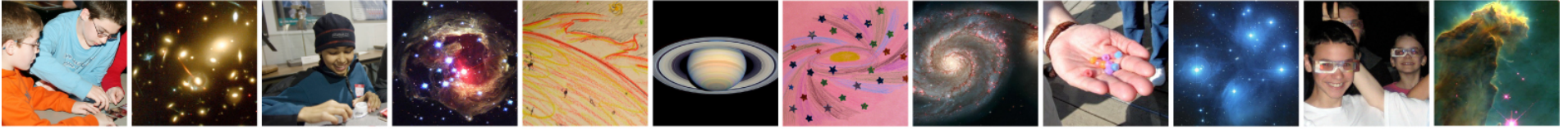
# Afterschool Universe Sessions

1. Modeling the Universe
2. Cosmic Survey
3. Astronomers' Tools – Telescope
4. Invisible Light
5. Astronomers' Tools – Spectroscopes
6. Life Cycles of Stars (1)
7. Life Cycles of Stars (2)
8. Our Cosmic Connection to the Elements
9. Galaxies\*
10. Black Holes
11. Visit by a (space) scientist or engineer + Making a Cosmic Quilt
12. Modeling the Universe – The Sequel

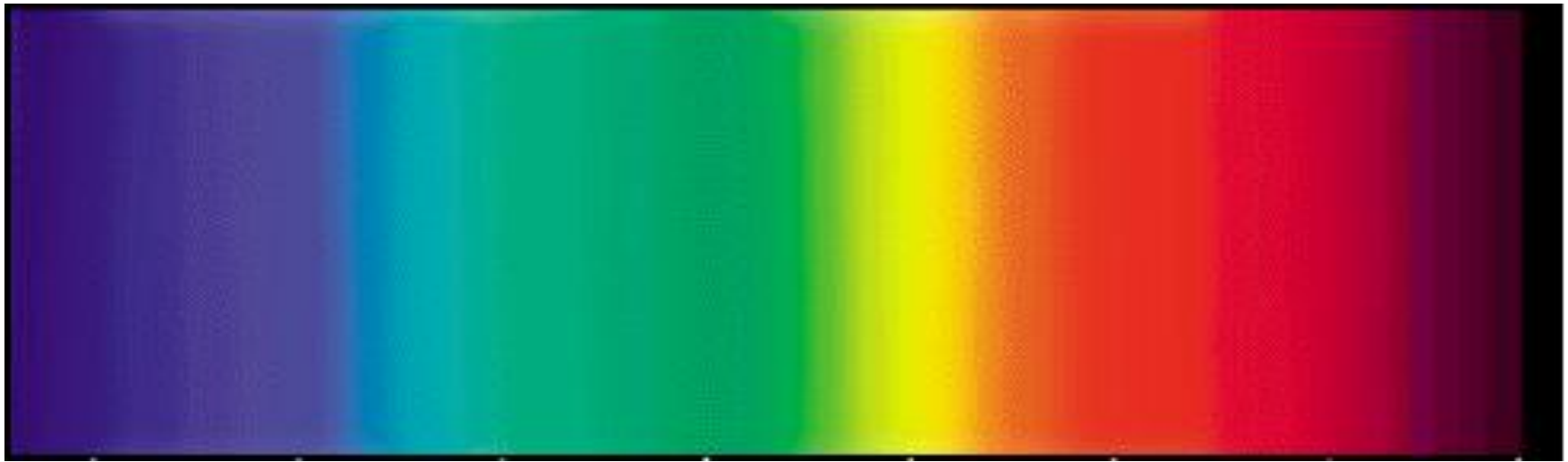


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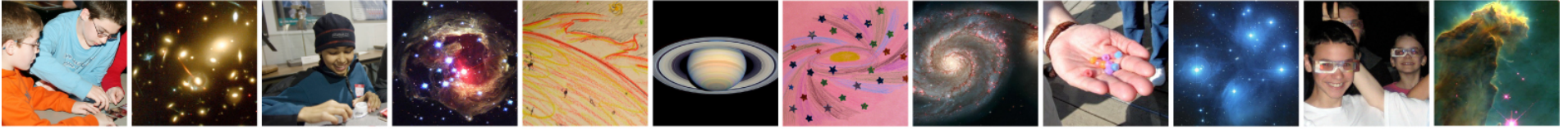


# The Spectrum

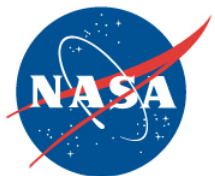
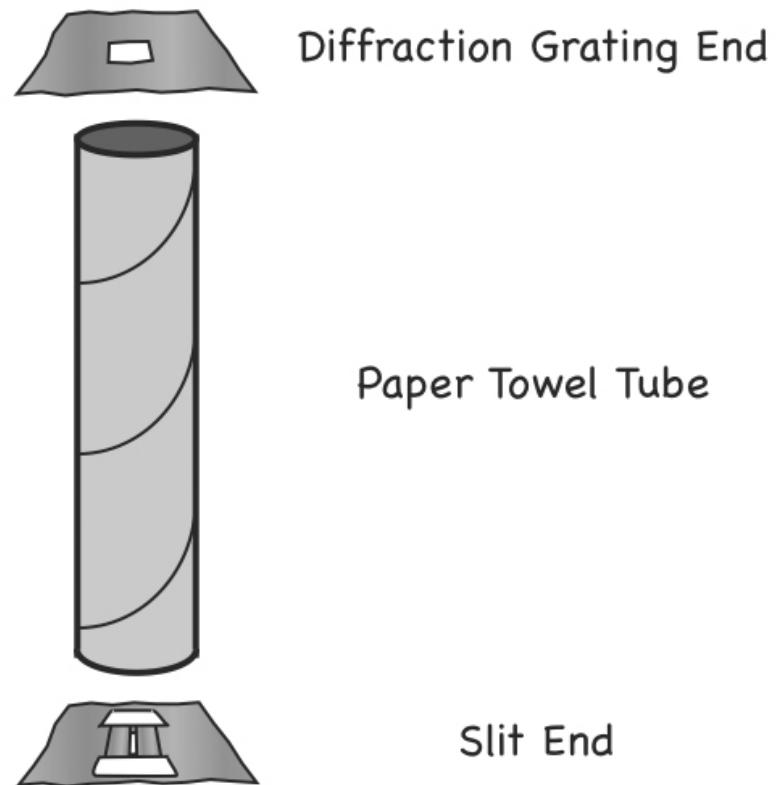


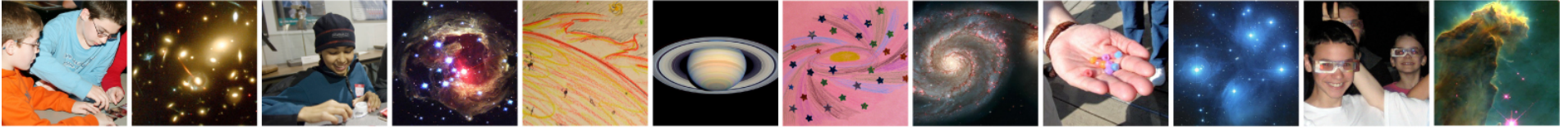
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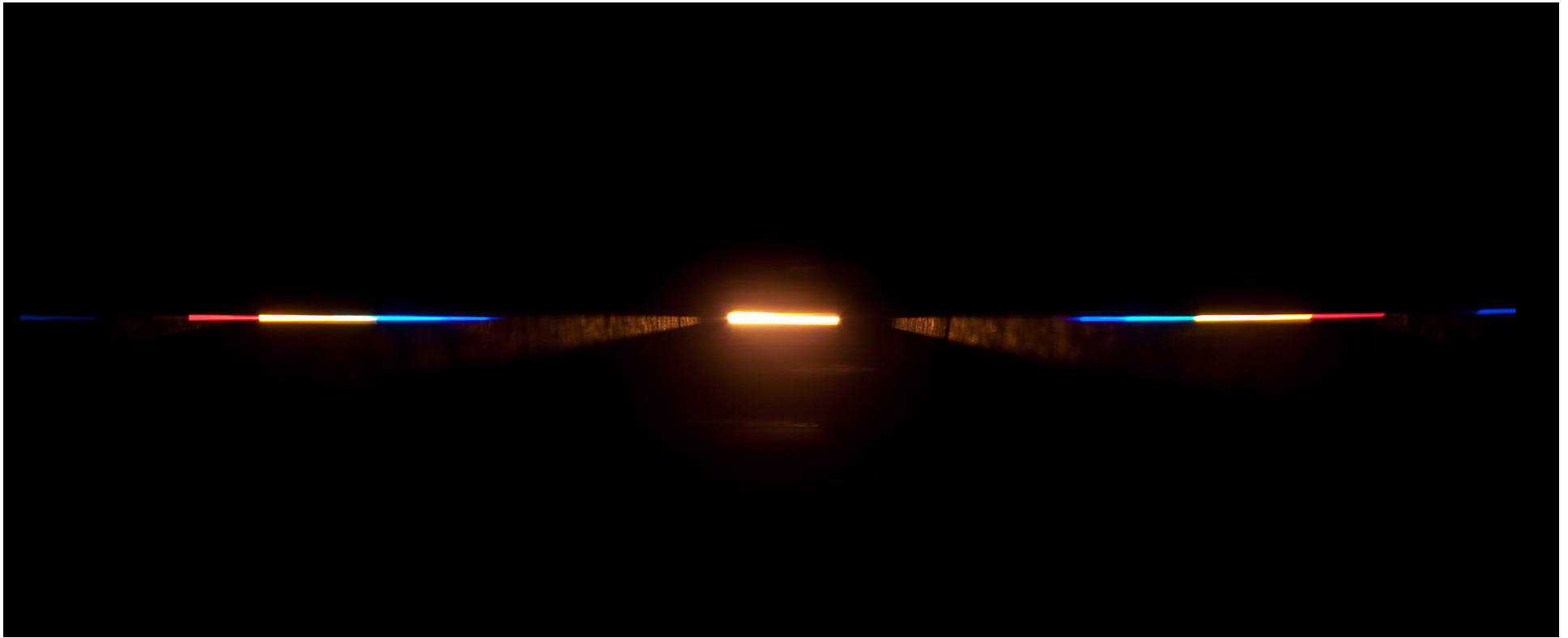


# Spectroscopes

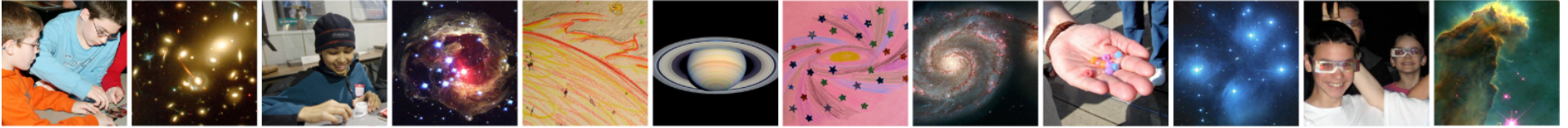




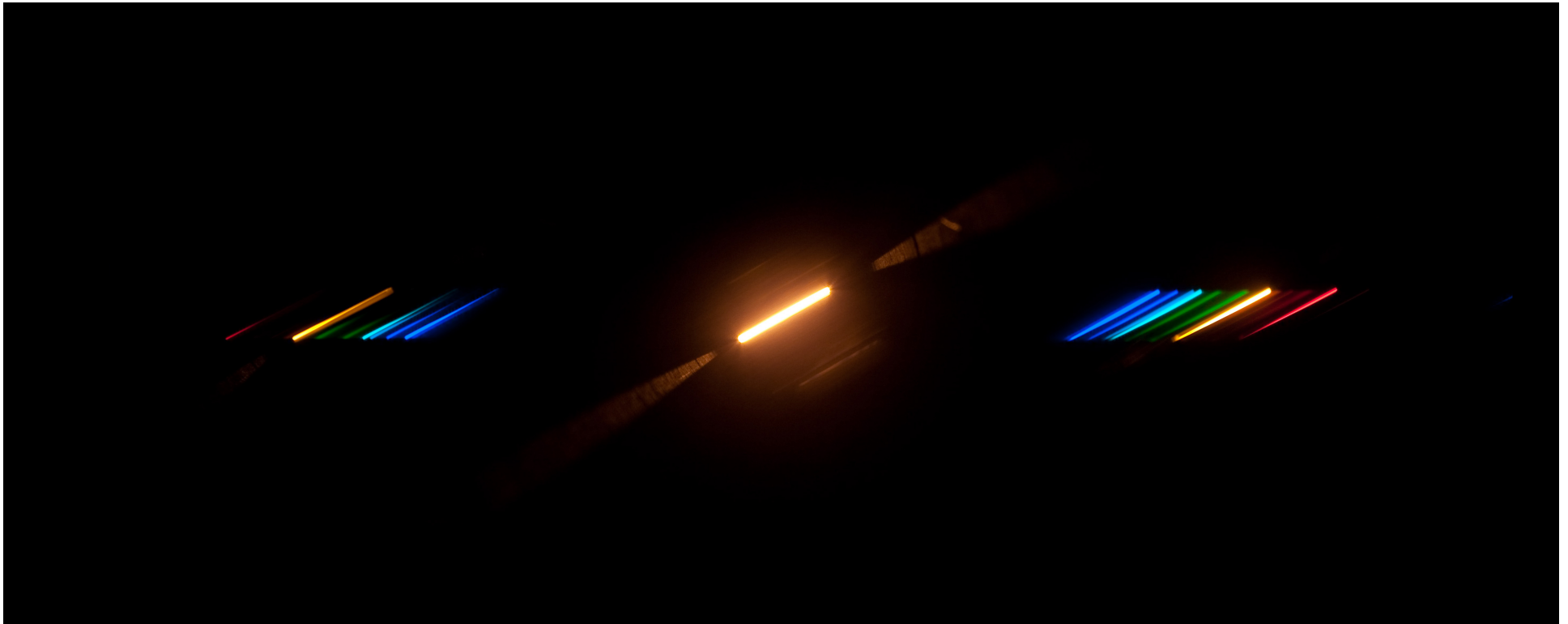
# The Spectrum



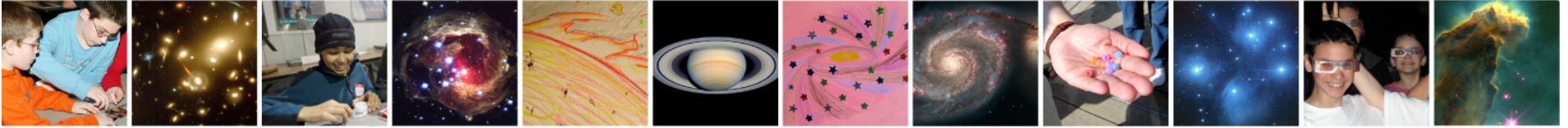
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# The Spectrum



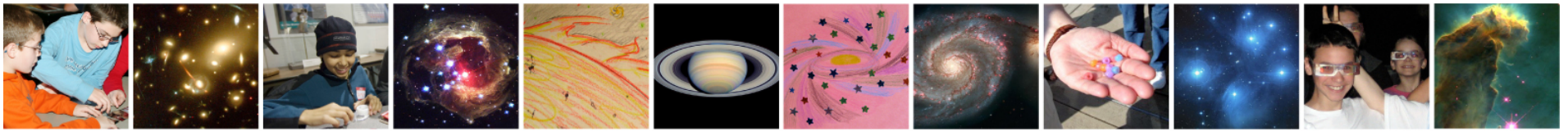
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# The Spectrum



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Hydrogen



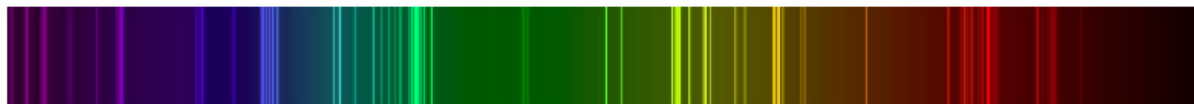
Helium



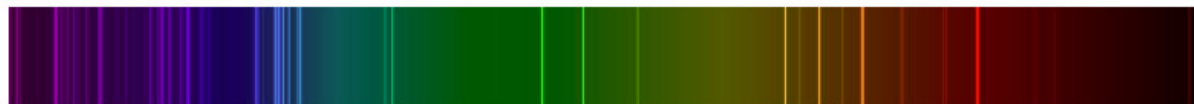
Carbon



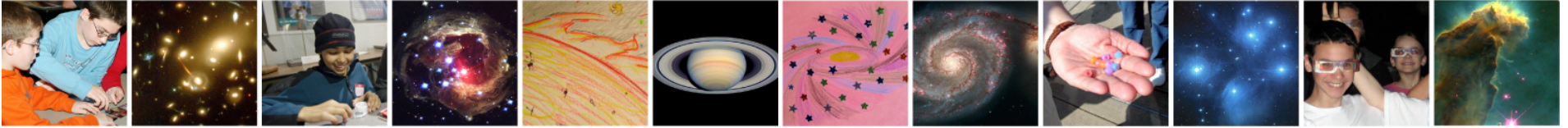
Nitrogen



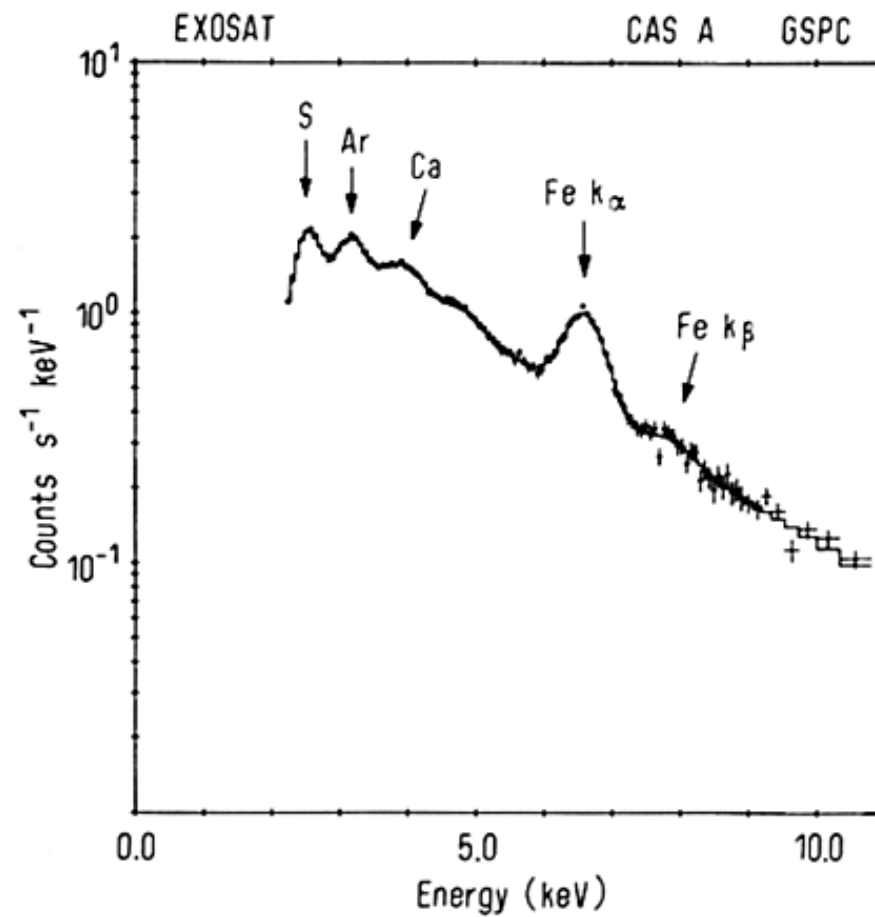
Oxygen



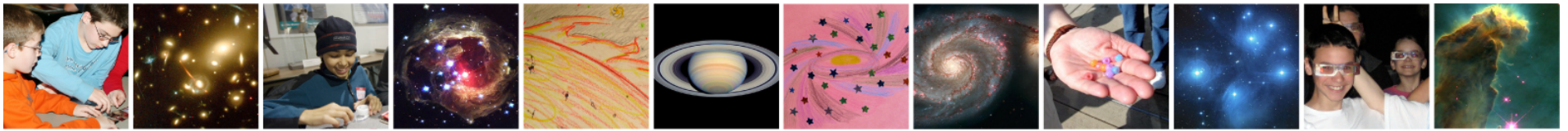




# What Astronomers See







## Universe Trail Mix



Black Beans = Oxygen (O)



Blue Sprinkles = Magnesium (Mg)



Green Split Peas = Helium (He)



Macaroni = Carbon (C)



Orange Sprinkles = Silicon (Si)



Green Sprinkles = Neon (Ne)



Pink Beans = Nitrogen (N)



Rice = Hydrogen (H)



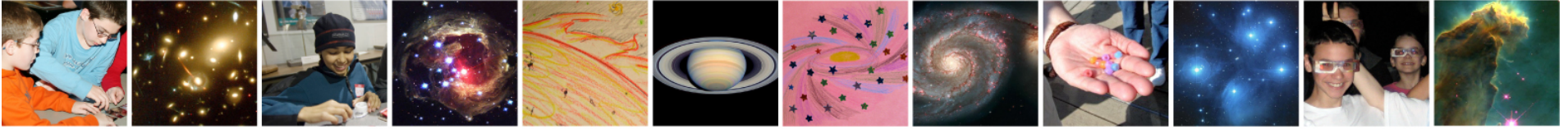
Red Sprinkles = Iron (Fe)



Yellow Sprinkles = Sulfur (S)



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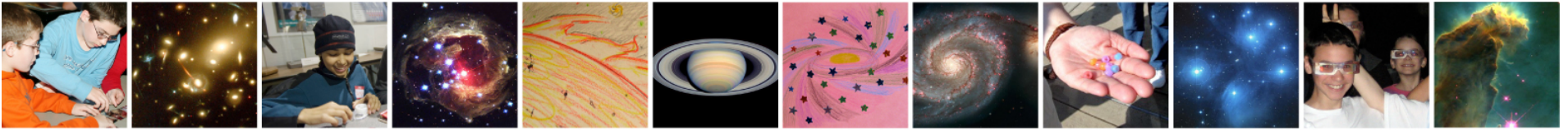


## Let's break it down!

- ★ How do these activities complement each other and meet different learning needs?
- ★ How could these activities enhance or extend what students are learning during the school day?





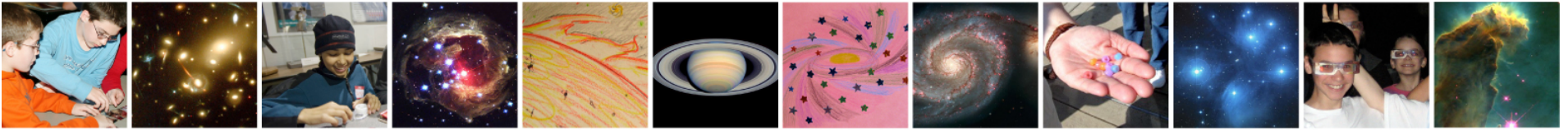


## Lessons Learned

- ★ STEM can be equally daunting for students and facilitators
- ★ Good STEM programming requires both solid curricula and motivated leadership
- ★ Even with the push to meet educational standards, the afterschool setting is *not* school – make sure it's fun and engaging
- ★ Evaluation in free choice learning environment can be challenging
- ★ Seek partners and assistance where you need it



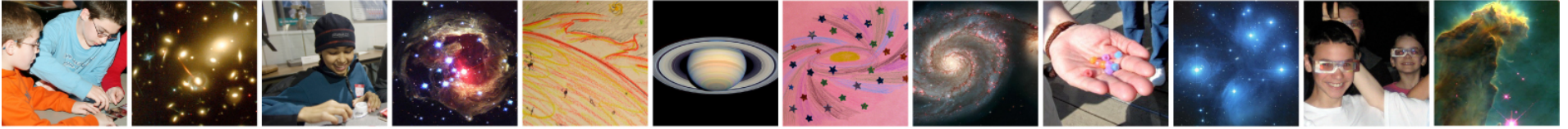




## Resources on Website

- ★ Comprehensive manual to run all of the sessions in the program
- ★ Each session is a self-contained recipe with background, activities, and extensions
- ★ YouTube videos to help illustrate some of the activities





## For more information...

We're going handout-free! All activities, resources, and links from this session are available at:

<http://imagine.gsfc.nasa.gov/educators/presentations/>

Or scan the QR code on your table!



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